U.S. Patent Application for:
NOVEL GLYCOSYL SULFOTRANSFERASES GST-4
ALPHA, GST-4BETA, & GST-6
Filing Date: October 29, 2003
Paula A. Borden (Reg. No. 42,344)
(650) 833-7710

FIG. 1

>human Glycosyl Sulfotransferase 4 (huGST-4α) complete cDNA (ORF in capitals)
ggctcgaggtccactgtgctgaatgtaagtctccttatcagaaagctcccagtgaggaactggtcttctggagactctgtgtggcat
agagtgattcaaccaccttaagaagacctctggctttcctggaacacagatgtcgagacatctcccatggatttgtgatcagcgttg
·cagctctcccagcagccctggacggtggcccccagccgcccgcATGTGGCTGCCACGGTTCTCCAGCA
AGACAGTGACAGTGCTCCTCCTGGCACAGACCACCTGCCTCCTGCTCTTCATC
ATCTCCCGGCCAGGGCCCTCATCCCCAGCCGGCGGCGAGGATCGTGTGCACGT
GCTGGTGCTGTCCTCGTGGCGCTCGGGCTCATCCTTCTTGGGCCAGCTCTTCAG
CCAGCACCCCGACGTCTTCTACCTGATGGAGCCCGCGTGGCATGTGTGGACCA
CCCTGTCGCAGGGCAGCGCGGCAACGCTGCACATGGCCGTGCGCGACCTGAT
GCGCTCTATCTTTTTGTGCGACATGGACGTGTTTGATGCCTACATGCCACAGA
GCCGAAACCTGTCCGCCTTTTTCAACTGGGCAACGAGCCGCGCGCTGTGCTCG
CCGCCCGCCTGCAGCGCCTTTCCCCGAGGCACCATCAGCAAGCAGGACGTAT
GCAAGACACTGTGCACGCGGCAGCCATTCAGCCTGGCCCGGGAGGCCTGCCG
CTCCTACAGCCACGTGGTGCTCAAGGAGGTGCGCTTCTTCAACCTGCAGGTGC
TCTACCCGCTGCTCAGCGACCCCGCGCTCAACCTGCGCATCGTGCACCTGGTG
CGCGACCCGCGGGCCGTGCTGCGCTCCCGGGAGGCGGCGGGCCCGATACTGG
CACGCGACAACGGCATCGTGCTGGGCACCAACGGCAAGTGGGTGGAGGCCGA
CCCTCACCTGCGCCTGATTCGCGAGGTGTGCCGCAGCCACGTGCGCATCGCCG
AGGCCGCCACACTCAAGCCGCCACCCTTCCTGCGCGGCCGCTACCGCCTGGTG
CGCTTCGAGGACCTGGCGCGGGAGCCGCTGGCAGAGATCCGCGCACTCTACG
CCTTCACCGGCCTGACCCTCACGCCACAGCTCGAGGCCTGGATCCACAACATC
ACCCACGGGTCGGGGATCGGCAAGCCAATCGAGGCCTTCCATACTTCGTCTAG
GAATGCGCGCAACGTCTCCCAGGCCTGGCGCCACGCGTTGCCCTTCACTAAGA
TCCTGCGCGTGCAGGAGGTGTGCGCCGGCGCGCTGCAGCTGCTGGGCTACCG
GCCTGTGTACTCTGCGGACCAGCAGCGTGACCTCACCCTGGATCTGGTGCTGC
CACGAGGCCCAGACCACTTCAGCTGGGCATCGCCTGACTGAgaactctgggccttagagc
aagccccgaactgtggtcgccaggcccaggaagcgactgcatggtggaaaaggagctggggcgcatggggaacaggtccct
actatcaaccgggagtttggggtcctcccctgaagtaagcaaggactgcacgtttctttctctcctgattctcggttttcctttgagtctt
ctggagctgccttctcatcaggtgcactcttcatggaaaagcaactcttgcccctacctcttctgggcgcagggagtaagttactgc
taaattaaattaaatgtgtgccaggccgggtgcggtggctcatgcctgtaatcccagcattttgagaggctgaggcgggtggatca·
cctgaggtcaggattcaaaaccagcctggccaacatagtgaaacccccctctctactaaaaatgcaaaaattagtccggcgtggtg
gcacactcctgtaatcccagctacttaggaggctgaggtgggaaatcacttggactccaaaggtggaggttgcagtaagctgaa
atcatgccactgcaccctagcttgggtggcaaagcaaaactctatcaaaaaaataattaataaatttgttcaaaagtcctgccgaaa
aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa (SEQ ID NOS. 03 & 04)

>human Glycosyl Sulfotransferase 4 (huGST-4α) translation of ORF from complete cDNA
MWLPRFSSKTVTVLLLAQTTCLLLFIISRPGPSSPAGGEDRVHVLVLSSWRSGSSFLGQLFSQHPDVF
YLMEPAWHVWTTLSQGSAATLHMAVRDLMRSIFLCDMDVFDAYMPQSRNLSAFFNWATSRALC
SPPACSAFPRGTISKQDVCKTLCTRQPFSLAREACRSYSHVVLKEVRFFNLQVLYPLLSDPALNLRIV
HLVRDPRAVLRSREAAGPILARDNGIVLGTNGKWVEADPHLRLIREVCRSHVRIAEAATLKPPPFLR
GRYRLVRFEDLAREPLAEIRALYAFTGLTLTPQLEAWIHNITHGSGIGKPIEAFHTSSRNARNVSQA
WRHALPFTKILRVQEVCAGALQLLGYRPVYSADQQRDLTLDLVLPRGPDHFSWASPD
(SEQ ID NO: 08)

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FIG. 2

>mouse Glycosyl Sulfotransferase 4 (huGST-4) complete cDNA (ORF in capitals)
ctcgagcactgttggcctactggaccaccgactgagcggctctttgtgtgcgccctgggtgcgcagcgcagaagcgcagcgggcagcgcaggccctagc
cagaggtATGCGGCTACCCCGTTTCTCCAGCACTGTCATGCTTTCGCTCCTGATGGTACAGACTGGC
ATCCTGGTCTTCCTGGTCTCCCGGCAAGTGCCATCGTCCCCAGCAGGCCTTGGGGAGCGTGTGC
ACGTGCTGGTACTGTCCTCGTGGCGCTCGGGCTCGTCCTTCGTGGGCCAGCTCTTCAGCCAACA
CCCCGATGTCTTCTACCTGATGGAGCCGGCTTGGCACGTCTGGGATACGTTGTCGCAGGGCAGT
GCCCCCGCACTCCACATGGCCGTGCGTGACCTGATCCGCTCAGTGTTCCTATGCGACATGGACG
TATTTGATGCCTACCTGCCCTGGCGCCGCAACATCTCGGATCTCTTCCAGTGGGCGGTGAGCCG
CGCATTGTGCTCACCTCCGGTCTGCGAAGCCTTCGCTCGTGGCAACATCAGCAGCGAGGAGGT
GTGTAAGCCTCTGTGCGCAACGCGGCCCTTCGGCCTGGCTCAGGAAGCCTGCAGCTCCTATAG
TCACGTCGTGCTCAAGGAGGTGCGCTTCTTTAACCTACAGGTGCTCTACCCGCTGCTCAGCGAC
CCTGCGCTCAACCTGCGCATCGTGCACCTAGTGCGCGACCCGCGGGCCGTGCTGCGCTCCCGA
GAGCAGACAGCCAAGGCGCTGGCACGGGACAATGGCATCGTCCTGGGTACCAACGGCACGTG
GGTGGAGGCGGACCCCCGGCTGCGCGTGGTCAACGAGGTATGCCGCAGCCATGTGCGCATCGC
AGAGGCAGCCTTGCACAAGCCGCCGCCCTTCTTGCAAGATCGCTACCGCCTGGTGCGCTACGA
GGATCTGGCCCGGGACCCACTCACCGTAATCCGTGAACTCTATGCCTTCACCGGCCTGGGTCTC
ACGCCGCAGCTCCAGACTTGGATCCACAATATCACGCATGGTTCAGGGCCAGGCGCGCGCCGT
GAAGCCTTCAAGACCACATCCAGGGATGCGCTCAGTGTATCCCAGGCCTGGCGCCACACGCTG
CCCTTTGCCAAGATTCGCCGGGTCCAGGAACTGTGCGGGGGTGCACTGCAGCTGCTGGGTTAC
CGGTCTGTGCATTCGGAGCTTGAGCAAAGGGACCTCTCTCTGGACCTCCTGCTGCCAAGAGGC
ATGGACAGTTTCAAGTGGGCATCGTCCACGGAGAAGCAACCGGAATCTTAGaattttagtggagagaccca
gctataacattagggtctattggagtatgataaagaaggggcttggagaacccaaaagcaagtagctgggagtgtgagtgatcttgtcctgtactaggaaagg
atggagtccaaatcccacatctctttctgtccagattgtagttttcggttgggtcttttagggtttggattcccaccaagtactatcgaatggaaagcaaaagctgt
gcccacttccttcagagaggcagccagcctcctactaaagcacttcctttctcgttgactctctcccctctttgatcataccatgcaatcgcagagaatggggtcc
caggcctgctctggagtgcgggaaaggcgcggctgtgggctggctcctaaaatctgtgcacctgcctctcgttggctcacccagacctctgctcactgccac
gccctagtatctcagtccatcatagacttggacagttatgggcctggtcaaggaggaaaatgagacgatgcttccctctgtgattctctgcctgaccttctagaa
gggaatccaggcacacacacaaccatacctgaggaggatggctttttaatgaatctttgatttgtcctaaaatgaaagatcctaatttatggaaataaacataaat
atgctgcgtgatcccaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa (SEQ ID NOS: 01 & 02)

>mouse Glycosyl Sulfotransferase 4 (huGST-4) translation of ORF from complete cDNA
MRLPRFSSTVMLSLLMVQTGILVFLVSRQVPSSPAGLGERVHVLVLSSWRSGSSFVGQLFSQHPDV
FYLMEPAWHVWDTLSQGSAPALHMAVRDLIRSVFLCDMDVFDAYLPWRRNISDLFQWAVSRALC
SPPVCEAFARGNISSEEVCKPLCATRPFGLAQEACSSYSHVVLKEVRFFNLQVLYPLLSDPALNLRIV
HLVRDPRAVLRSREQTAKALARDNGIVLGTNGTWVEADPRLRVVNEVCRSHVRIAEAALHKPPPF
LQDRYRLVRYEDLARDPLTVIRELYAFTGLGLTPQLQTWIHNITHGSGPGARREAFKTTSRDALSVS
QAWRHTLPFAKIRRVQELCGGALQLLGYRSVHSELEQRDLSLDLLLPRGMDSFKWASSTEKQPES
(SEQ ID NO: 07)

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FIG. 3

>human GST-6 cDNA encoding GST-6 polypeptide fragment
cttggcggaggaggttggTGAtgcagctggggaaataatcactgcctctcaacatggggaaatggtatttgtgagtggggaagccgtgtctgcttattcttc
agcaatgagactgaaaagtgtatatcgggctttgcttctttaaattcccaaactctgctagttgttgatcatattgagaggcaagaagattccccaataaattctgtc
agtgccttctttcataatttggatattgattttaaatatatcccatataagtttATGAATAGGTATAATGGTGCCATGATGGATGTGT
GGGATGCACATTACAAAATGTTTTGGTTTGATCATCATGGCAATAGTCCCATGGCCAGTATACA
GGAAGCAGAGCAAGCTGCTGAATTTAAAAAACGATGGACTCAATTTGTTAATGTTACTTTTCA
GATGGAATCCACAATCACAAGAATTGCATATGTCTTTTATGGGCCATATATCAATGTCTCCAGC
TGCAGATTTATTGATAGTTCCAATCCTGGACTTCAGATTTCTCTCAATGTCAATAATACTGAAC
ATGTTGTTTCTATTGTAACTGATTACCATAACCTGAAGACAAGATTCAATTATCTGGGATTCGG
TGGCTTTGCCAGTGTGGCTGATCAAGGCCAAATAACCCGATTTGGTTTGGGCACTCAAGCAAT
AGTAAAGCCTGTAAGACATGATAGGATTATTTTCCCCTTTGGATTTAAATTTAATATAGCAGTT
GGATTAATTTTGTGCATTAGCTTGGTGATTTTAACTTTCCAATGGCGTTTTTACCTTTCTTTTAG
AAAACTAATGCGATGGATATTAATACTTGTTATTGCCTTGTGGTTTATTGAGCTTTTGGATGTG
TGGAGCACTTGTAGTCAGCCCATTTGTGCAAAATGGACAAGGACAGAGGCTGAGGGAAGCAA
GAAGTCTTTGTCTTCTGAAGGGCACCACATGGATCTTCCTGATGTTGTCATTACCTCACTTCCTG
GTTCAGGAGCTGAAATTCTCAAACAACTTTTTTTCAACAGTAGTGATTTTCTCTACATCAGGGT
TCCTACAGCCTACATTGATATTCCTGAAACTGAGTTGGAAATCGACTCATTTGTAGATGCTTGT
GAATGGAAGGTGTCAGATATCCGCAGTGGGCATTTTCGTTTACTCCGAGGCTGGTTGCAGTCTT
TAGTCCAGGACACAAAATTACATTTGCAAAACATCCATCTGCATGAACCCAATAGGGGTAAAC
TGGCCCAATATTTTGCAATGAATAAGGACAAAAAAAGAAAATTTAAAAGGAGAGAGTCTTTGC
CAGAACAAAGAAGTCAAATGAAAGGCGCCTTTGATAGAGATGCTGAATATATTAGGGCTTTGA
GGAGACACCTGGTTTACTATCCAAGTGCACGTCCTGTGCTCAGTTTAAGCAGTGGAAGCTGGA
CGTTAAAGCTTCATTTTTTTCAGGAAGTTTTAGGAGCTTCGATGAGGGCATTGTACATAGTAAG
AGACCCTCGGGCATGGATTTATTCAATGTTGTACAATAGTAAACCAAGTCTTTATTCTTTGAAG
AATGTACCAGAGCATTTAGCAAAATTGTTTAAAATAGAGGGAGGTAAAGGCAAATGTAACTTA
AATTCGGGTTATGCTTTCGAGTATGAACCATTGAGGAAAGAATTATCAAAATCCAAATCAAAT
GCAGTGTCCCTCTTGTCTCACTTGTGGCTAGCAAATACAGCAGCAGCCTTGAGAATAAATACA
GATTTGCTGCCTACTAGCTACCAGCTGGTCAAGTTTGAAGATATTGTGCATTTTCCTCAGAAAA
CTACTGAAAGGATTTTTGCCTTTCTTGGAATTCCTTTGTCTCCTGCTAGTTTAAACCAAATATTG
TTTGCCACCTCTACAAACCTTTTTTACCTTCCCTATGAAGGGGAAATATCACCAACTAATACTA
ATGTTTGGAAACAGAACTTGCCTAGAGATGAAATTAAACTAATTGAAAACATCTGCTGGACTC
TGATGGATCGCCTAGGATATCCAAAGTTTATGGACTAAatgctgcaggtcagcagaaatttgcactaataatacttacca
acccactttgtggatatgaatcagaagagtttgtttattctttagtgtgtgtgtgtgtgtgtgcacgcgtgtatgtgttcagtgttgtttgcacagagagattgttttaa
aaaatggcaccatatttggcctagcaggatttattttttatgtcatcacctcccttgcctttgtttctgaaaattttgtctgctaaaaagtttctgctacagagtggtagat
gaagttatatcatgggggtcaggggagatgggaaaattttaagtttttgtctaactcccccttcatctgtaactgtgctaatctatctagagacctcaaacactgctaa
aggccttgcaattgctgctttacccacgcatctcttgctttcaagaaggactacaaaagttccttatccttttgaaaaggtcttctgacacacttatcttgcacaaag
aaaaagaaaattt (SEQ ID NOS: 05 & 06)

>human GST-6 polypeptide fragment (translation of ORF)
MNRYNGAMMDVWDAHYKMFWFDHHGNSPMASIQEAEQAAEFKKRWTQFVNV
TFQMESTITRIAYVFYGPYINVSSCRFIDSSNPGLQISLNVNNTEHVVSIVTDYHNL
KTRFNYLGFGGFASVADQGGQITRFGLGTQAIVKPVRHDRIIFPFGFKFNIAVGLILC
ISLVILTFQWRFYLSFRKLMRWILILVIALWFIELLDVWSTCSQPICAKWTRTEAEG
SKKSLSSEGHHMDLPDVVITSLPGSGAEILKQLFFNSSDFLYIRVPTAYIDIPETELEI
DSFVDACEWKVSDIRSGHFRLLRGWLQSLVQDTKLHLQNIHLHEPNRGKLAQYF
AMNKDKKRKFKRRESLPEQRSQMKGAFDRDAEYIRALRRHLVYYPSARPVLSLS
SGSWTLKLHFFQEVLGASMRALYIVRDPRAWIYSMLYNSKPSLYSLKNVPEHLA
KLFKIEGGKGKCNLNSGYAFEYEPLRKELSKSKSNAVSLLSHLWLANTAAALRIN
TDLLPTSYQLVKFEDIVHFPQKTTERIFAFLGIPLSPASLNQILFATSTNLFYLPYEG
EISPTNTNVWKQNLPRDEIKLIENICWTLMDRLGYPKFMD (SEQ ID NO:09)

FIG. 4A

(human GST4β complete cDNA, ORF highlighted in capitals)

ggcacgaggacgacgtttgggagcctttgctgagtccagggagagaggcgtcccccaccgtgccgctgcagctcggg
cagagccgccaagctttggggtgctgaggaacctctaatcatctcccatggatttgtgatcagcgttgcagctctcc
cagcagccctggacagtggcccccagcagtcagcATGTGGCTGCCGCGCGTCTCCAGCACAGCAGTGACCGCGCTCC
TCCTGGCGCAGACCTTCCTCCTCCTCTTTCTGGTTTCCCGGCCAGGGCCCTCGTCCCCAGCAGGCGGCGAGGCGCGC
GTGCATGTGCTGGTGCTGTCCTCGTGGCGCTCGGGCTCGTCCTTCGTGGGCCAACTCTTCAACCAGCACCCCGACGT
CTTCTACCTAATGGAGCCCGCGTGGCACGTGTGGACCACCCTGTCGCAGGGCAGCGCCGCAACGCTGCACATGGCTG
TGCGCGACCTGGTGCGCTCCGTCTTCCTGTGCGACATGGACGTGTTTGATGCCTATCTGCCTTGGCGCCGCAACCTG
TCCGACCTCTTCCAGTGGGCCGTGAGCCGTGCACTGTGCTCGCCACCCGCCTGCAGTGCCTTTCCCCGAGGCGCCAT
CAGCAGCGAGGCCGTGTGCAAGCCACTGTGCGCGCGGCAGTCCTTCACCCTGGCCCGGGAGGCCTGCCGCTCCTACA
GCCACGTGGTGCTCAAGGAGGTGCGCTTCTTCAACCTGCAGGTGCTCTACCCGCTGCTCAGCGACCCCGCGCTCAAC
CTACGCATCGTGCACCTGGTGCGCGACCCGCGGGCCGTGCTGCGCTCCCGGGAGCAGACAGCCAAGGCTCTGGCGCG
TGACAACGGCATCGTGCTGGGCACCAACGGCACGTGGGTGGAGGCCGACCCCGGCCTGCGCGTGGTGCGCGAGGTGT
GCCGTAGCCACGTACGCATCGCCGAGGCCGCCACACTCAAGCCGCCACCCTTTCTGCGCGGCCGCTACCGCCTGGTG
CGCTTCGAGGACCTGGCGCGGGAGCCGCTGGCAGAAATCCGTGCGCTCTACGCCTTCACTGGGCTCAGTCTCACGCC
ACAGCTCGAGGCCTGGATCCATAACATCACCCACGGATCTGGACCTGGTGCGCGCCGCGAAGCCTTCAAGACTTCGT
CCAGGAATGCGCTCAACGTCTCCCAGGCCTGGCGCCATGCGCTGCCCTTTGCCAAGATCCGCCGCGTGCAGGAACTG
TGCGCTGGTGCGCTGCAGCTGCTGGGCTACCGGCCTGTGTACTCTGAGGACGAGCAGCGCAACCTCGCCCTTGATCT
GGTGCTGCCACGAGGCCTGAACGGCTTCACTTGGGCATCATCCACCGCCTCGCACCCCCGAAATTAGtggaggccac
agttgtagcaggcgctaggcccgggaggagagtgcatggtgcagaggggggctggggcgcacggagaagcaggtccct
atattgaccaaggagtttgtggtacgacccctcccctccccaagtaggcaaggactgcacgtttctttctctcttg
attcttggttttcctttgagtcctctggagctgccttctcatcaggtgcactcttcatggaaagcaactcttgcccc
tgcctcctctgggcacagggtgtgcgttcagatgacttggctcctactcaagggctttcttccccctggagaagaga

FIG. 4B

(human GST4β, translation of ORF)

MWLPRVSSTAVTALLLAQTFLLLFLVSRPGPSSPAGGEARVHVLVLSSWRSGSSFVGQLFNQHPDVFYLMEPAWHVWT
TLSQGSAATLHMAVRDLVRSVFLCDMDVFDAYLPWRRNLSDLFQWAVSRALCSPPACSAFPRGAISSEAVCKPLCARQ
SFTLAREACRSYSHVVLKEVRFFNLQVLYPLLSDPALNLRIVHLVRDPRAVLRSREQTAKALARDNGIVLGTNGTWVE
ADPGLRVVREVCRSHVRIAEAATLKPPPFLRGRYRLVRFEDLAREPLAEIRALYAFTGLSLTPQLEAWIHNITHGSGP
GARREAFKTSSRNALNVSQAWRHALPFAKIRRVQELCAGALQLLGYRPVYSEDEQRNLALDLVLPRGLNGFTWASSTA
SHPRN

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FIG. 5A

(human GST6 complete cDNA, ORF highlighted in capitals)

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ATGCCTAAGGGAGGAGCTCCCCCATGGATCATGGCGTTAATGTTTACAGGACATTTACTATTCTTAGCATTATTGATG
TTTGCTTTCTCTACTTTTGAGGAATCTGTGAGCAATTATTCCGAATGGGCAGTTTTCACAGATGATATAGATCAGTTT
AAAACACAGAAAGTGCAAGATTTCAGACCCAACCAAAAGCTGAAGAAAAGTATGCTTCATCCAAGTTTATATTTTGAT
GCTGGAGAAATCCAAGCAATGAGACAAAAGTCTCGTGCAAGCCATTTGCATCTTTTTAGAGCTATCAGAAGTGCAGTG
ACAGTTATGCTGTCCAACCCAACATACTACCTACCTCCACCAAAGCATGCTGATTTTGCTGCCAAGTGGAATGAAATT
TATGGTAACAATCTGCCTCCTTTAGCATTGTACTGTTTGTTATGCCCAGAAGACAAAGTTGCCTTTGAATTTGTCTTG
GAATATATGGACAGGATGGTTGGCTACAAAGACTGGCTAGTAGAGAATGCACCAGGAGATGAGGTTCCAATTGGCCAT
TCCTTAACAGGTTTTGCCACTGCCTTTGACTTTTTATATAACTTATTAGATAATCATCGAAGACAAAAATACCTGGAA
AAAATATGGGTTATTACTGAGGAAATGTACGAGTATTCCAAGGTCCGCTCATGGGGCAAACAGCTTCTCCATAACCAC
CAAGCCACTAATATGATAGCATTACTCACAGGGGCCTTGGTGACTGGAGTAGATAAAGGATCTAAAGCAAATATATGG
AAACAGGCTGTAGTGGATGTCATGGAAAAGACAATGTTTCTATTGAATCATATTGTTGATGGTTCTTTGGATGAAGGT
GTGGCCTATGGAAGCTACACAGCTAAATCCGTCACACAGTATGTTTTTCTGGCCCAGCGCCATTTTAATATCAACAAC
TTGGATAATAACTGGTTAAAGATGCACTTTTGGTTCTATTATGCCACCCTTTTACCTGGCTTCCAAAGAACTGTGGGT
ATAGCAGATTCCAATTATAATTGGTTTTATGGTCCAGAAAGCCAGCTAGTTTTCTTGGATAAGTTCATCTTAAAGAAT
GGAGCTGGAAATTGGTTAGCTCAGCAAATTAGAAAGCACCGACCTAAAGATGGACCGATGGTTCCTTCAACTGCCCAA
AGGTGGAGTACTCTTCACACTGAATACATCTGGTATGATCCCCAGCTCACACCACAGCCACCTGCTGATTATGGTACT
GCAAAAATACACACATTCCCTAACTGGGGTGTGGTTACTTATGGGGCTGGGTTGCCAAACACACAGACCAACACCTTT
GTGTCTTTTAAATCTGGGAAGCTGGGGGGACGAGCTGTGTATGACATAGTTCATTTTCAGCCATATTCCTGGATTGAT
GGGTGGAGAAGTTTTAACCCAGGACATGAGCATCCAGATCAGAACTCATTTACTTTTGCCCCCAATGGACAAGTATTT
GTTTCTGAAGCTCTCTATGGACCCAAGTTGAGCCACCTTAACAATGTATTGGTGTTTGCTCCATCACCCTCAAGCCAG
TGTAATAAGCCCTGGGAAGGTCAACTGGGAGAATGTGCGCAGTGGCTTAAGTGGACTGGCGAGGAGGTTGGTGATGCA
GCTGGGGAAATAATCACTGCCTCTCAACATGGGGAAATGGTATTTGTGAGTGGGGAAGCCGTGTCTGCTTATTCTTCA
GCAATGAGACTGAAAAGTGTATATCGTGCTTTGCTTCTCTTAAATTCCCAAACTCTGCTAGTTGTTGATCATATTGAG
AGGCAAGAAGATTCCCCAATAAATTCTGTCAGTGCCTTCTTTCATAATTTGGATATTGATTTTAAATATATCCCATAT
AAGTTTATGAATAGGTATAATGGTGCCATGATGGATGTGTGGGATGCACATTACAAAATGTTTTGGTTTGATCATCAT
GGCAATAGTCCCATGGCCAGTATACAGGAAGCAGAGCAAGCTGCTGAATTTAAAAAACGATGGACTCAATTTGTTAAT
GTTACTTTTCAGATGGAATCCACAATCACAAGAATTGCATATGTCTTTTATGGGCCATATATCAATGTCTCCAGCTGC
AGATTTATTGATAGTTCCAATCCTGGACTTCAGATTTCTCTCAATGTCAATAATACTGAACATGTTGTTTCTATTGTA
ACTGATTACCATAACCTGAAGACAAGATTCAATTATCTGGGATTCGGTGGCTTTGCCAGTGTGGCTGATCAAGGCCAA
ATAACCCGATTTGGTTTGGGCACTCAAGCAATAGTAAAGCCTGTAAGACATGATAGGATTATTTTCCCCTTTGGATTT
AAATTTAATATAGCAGTTGGATTAATTTTGTGCATTAGCTTGGTGATTTTAACTTTCCAATGGCGTTTTTACCTTTCT
TTTAGAAAACTAATGCGATGGATATTAATACTTGTTATTGCCTTGTGGTTTATTGAGCTTTTGGATGTGTGGAGCACT
TGTAGTCAGCCCATTTGTGCAAAATGGACAAGGACAGAGGCTGAGGGAAGCAAGAAGTCTTTGTCTTCTGAAGGGCAC
CACATGGATCTTCCTGATGTTGTCATTACCTCACTTCCTGGTTCAGGAGCTGAAATTCTCAAACAACTTTTTTTCAAC
AGTAGTGATTTTCTCTACATCAGGGTTCCTACAGCCTACATTGATATTCCTGAAACTGAGTTGGAAATCGACTCATTT
GTAGATGCTTGTGAATGGAAGGTGTCAGATATCCGCAGTGGGCATTTTCGTTTACTCCGAGGCTGGTTGCAGTCTTTA
GTCCAGGACACAAAATTACATTTGCAAAACATCCATCTGCATGAACCCAATAGGGGTAAACTGGCCCAATATTTTGCA
ATGAATAAGGACAAAAAAGAAAATTTAAAAGGAGAGAGTCTTTGCCAGAACAAAGAAGTCAAATGAAAGGCGCCTTT
GATAGAGATGCTGAATATATTAGGGCTTTGAGGAGACACCTGGTTTACTATCCAAGTGCACGTCCTGTGCTCAGTTTA
AGCAGTGGAAGCTGGACGTTAAAGCTTCATTTTTTTCAGGAAGTTTTAGGAGCTTCGATGAGGGCATTGTACATAGTA
AGAGACCCTCGGGCATGGATTTATTCAATGTTGTACAATAGTAAACCAAGTCTTTATTCTTTGAAGAATGTACCAGAG
CATTTAGCAAAATTGTTTAAAATAGAGGGAGGTAAAGGCAAATGTAACTTAAATTCGGGTTATGCTTTCGAGTATGAA
CCATTGAGGAAAGAATTATCAAAATCCAAATCAAATGCAGTGTCCCTCTTGTCTCACTTGTGGCTAGCAAATACAGCA
GCAGCCTTGAGAATAAATACAGATTTGCTGCCTACTAGCTACCAGCTGGTCAAGTTTGAAGATATTGTGCATTTTCCT
CAGAAAACTACTGAAAGGATTTTTGCCTTTCTTGGAATTCCTTTGTCTCCTGCTAGTTTAAACCAAATATTGTTTGCC
ACCTCTACAAACCTTTTTTACCTTCCCTATGAAGGGGAAATATCACCAACTAATACTAATGTTTGGAAACAGAACTTG
CCTAGAGATGAAATTAAACTAATTGAAAACATCTGCTGGACTCTGATGGATCGCCTAGGATATCCAAAGTTTATGGAC
TAAatgctgcaggtcagcagaaatttgcactaataatacttaccaacccaaaaaaaaaaaaaaaaa
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FIG. 5B
(human GST-6, translation of ORF)

MPKGGAPPWIMALMFTGHLLFLALLMFAFSTFEESVSNYSEWAVFTDDIDQFKTQKVQDFRPNQKLKKSMLHPSLYFD
AGEIQAMRQKSRASHLHLFRAIRSAVTVMLSNPTYYLPPPKHADFAAKWNEIYGNNLPPLALYCLLCPEDKVAFEFVL
EYMDRMVGYKDWLVENAPGDEVPIGHSLTGFATAFDFLYNLLDNHRRQKYLEKIWVITEEMYEYSKVRSWGKQLLHNH
QATNMIALLTGALVTGVDKGSKANIWKQAVVDVMEKTMFLLNHIVDGSLDEGVAYGSYTAKSVTQYVFLAQRHFNINN
LDNNWLKMHFWFYYATLLPGFQRTVGIADSNYNWFYGPESQLVFLDKFILKNGAGNWLAQQIRKHRPKDGPMVPSTAQ
RWSTLHTEYIWYDPQLTPQPPADYGTAKIHTFPNWGVVTYGAGLPNTQTNTFVSFKSGKLGGRAVYDIVHFQPYSWID
GWRSFNPGHEHPDQNSFTFAPNGQVFVSEALYGPKLSHLNNVLVFAPSPSSQCNKPWEGQLGECAQWLKWTGEEVGDA
AGEIITASQHGEMVFVSGEAVSAYSSAMRLKSVYRALLLLNSQTLLVVDHIERQEDSPINSVSAFFHNLDIDFKYIPY
KFMNRYNGAMMDVWDAHYKMFWFDHHGNSPMASIQEAEQAAEFKKRWTQFVNVTFQMESTITRIAYVFYGPYINVSSC
RFIDSSNPGLQISLNVNNTEHVVSIVTDYHNLKTRFNYLGFGGFASVADQGQITRFGLGTQAIVKPVRHDRIIFPFGF
KFNIAVGLILCISLVILTFQWRFYLSFRKLMRWILILVIALWFIELLDVWSTCSQPICAKWTRTEAEGSKKSLSSEGH
HMDLPDVVITSLPGSGAEILKQLFFNSSDFLYIRVPTAYIDIPETELEIDSFVDACEWKVSDIRSGHFRLLRGWLQSL
VQDTKLHLQNIHLHEPNRGKLAQYFAMNKDKKRKFKRRESLPEQRSQMKGAFDRDAEYIRALRRHLVYYPSARPVLSL
SSGSWTLKLHFFQEVLGASMRALYIVRDPRAWIYSMLYNSKPSLYSLKNVPEHLAKLFKIEGGKGKCNLNSGYAFEYE
PLRKELSKSKSNAVSLLSHLWLANTAAALRINTDLLPTSYQLVKFEDIVHFPQKTTERIFAFLGIPLSPASLNQILFA
TSTNLFYLPYEGEISPTNTNVWKQNLPRDEIKLIENICWTLMDRLGYPKFMD

U.S. Patent Application for:
NOVEL GLYCOSYL SULFOTRANSFERASES GST-4
ALPHA, GST-4BETA, & GST-6
Filing Date: October 29, 2003
Paula A. Borden (Reg. No. 42,344)
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FIG. 6A
(mouse GST6 cDNA, ORF highlighted in capitals)

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ATGGCGTTTATGTTTACAGAACATTTACTATTTTTAACATTGATGATGTGTAGTTTTTCTACTTGTGAAGAATCTGTG
AGCAATTATTCTGAATGGGCAGTTTTCACAGACGATATACAATGGCTTAAGTCACAGAAAATACAAGATTTCAAACTC
AACCGAAGACTTCATCCAAATTTATATTTTGATGCTGGAGATATACAAACATTGAAACAAAAGTCTCGTACAAGCCAT
TTGCATATTTTTAGAGCTATCAAAAGTGCAGTGACAATTATGCTGTCCAATCCATCATACTACCTACCTCCACCCAAG
CATGCTGAGTTTGCTGCCAAGTGGAATGAAATTTATGGTAATAATCTTCCTCCTTTAGCATTGTATTGTTTATTATGC
CCAGAAGACAAGGTTGCCTTTGAATTTGTTATGGAATACATGGATCGGATGGTTAGCTACAAAGACTGGCTAGTTGAG
AATGCACCAGGGGATGAGGTTCCAGTTGGCCATTCTTTAACAGGTTTTGCCACTGCCTTTGACTTTTTATATAATCTA
TTAGGTAATCAGCGTAAACAAAAATACCTAGAAAAAATTTGGATTGTTACTGAGGAAATGTATGAATATTCCAAGATT
CGATCATGGGGCAAACAACTTCTTCATAACCATCAAGCTACAAATATGATAGCTTTACTCATAGGGGCCTTGGTTACT
GGAGTAGATAAAGGATCTAAAGCAAACATATGGAAACAAGTTGTTGTTGATGTGATGGAAAGACTATGTTTCTCTTG
AAGCATATTGTAGATGGCTCATTGGATGAAGGTGTGGCCTATGGAAGCTATACCTCAAATCAGTTACACAGTATGTT
TTTTTGGCACAACGCCATTTTAACATCAACAACTTTGATAATAACTGGCTAAAAATGCATTTTTGGTTTTATTATGCT
ACACTTTTGCCAGGCTATCAAAGAACTGTAGGCATAGCAGATTCCAATTATAATTGGTTTTATGGTCCAGAGAGCCAG
CTAGTTTTCTTGGATAAGTTCATTTTACAGAATGGAGCTGGAAATTGGTTAGCTCAGCAAATTAGAAAGCATCGACCT
AAGGATGGACCAATGGTTCCTTCCACTGCTCAGCGGTGGAGTACTCTTCATACTGAATACATCTGGTATGATCCAACA
CTCACCCCACAGCCTCCTGTTGATTTTGGCACTGCAAAAATGCACACATTTCCTAACTGGGGTGTCGTGACTTATGGG
GGTGGGCTGCCAAACACCCAGACCAATACCTTTGTGTCTTTTAAATCTGGGAAACTGGGAGGACGAGCTGTGTATGAC
ATAGTTCACTTTCAGCCATATTCCTGGATTGATGGATGGAGAAGCTTTAACCCAGGACATGAACATCCAGATCAAAAT
TCATTTACTTTCGCTCCTAATGGGCAGGTATTCGTTTCTGAGGCTCTTTATGGACCAAAATTGAGCCACCTTAACAAC
GTATTGGTGTTTGCCCCATCACCATCAAGTCAATGTAATCAGCCCTGGGAAGGTCAACTGGGAGAATGTGCACAGTGG
CTCAAGTGGACTGGGGAAGAGGTTGGTGATGCAGCTGGGGAAGTTATTACTGCTGCTCAACATGGTGATAGGATGTTT
GTGAGTGGGGAAGCAGTGTCTGCTTATTCTTCTGCCATGAGACTGAAAAGTGTCTATCGTGCTTTACTTCTTTTAAAT
TCACAAACTCTGCTTGTTGTCGATCATATTGAAAGGCAAGAAACTTCCCCAATAAATTCTGTCAGTGCCTTCTTTCAT
AATTTGGATATTGATTTTAAATACATCCCATACAAGTTTATGAATAGATATAATGGTGCCATGATGGATGTGTGGGAT
GCACACTATAAAATGTTTTGGTTTGATCACCATGGCAACAGTCCTGTGGCTAATATACAGGAAGCAGAACAGGCTGCT
GAATTTAAGAAACGGTGGACACAGTTTGTTAATGTTACATTTCATATGGAATCCACAATCACAAGAATTGCTTATGTA
TTTTATGGGCCATATGTCAATGTTTCCAGCTGCAGATTTATTGATAGTTCCAGTTCTGGACTTCAGATTTCTTTACAT
GTCAACAGTACTGAACATAGTGTGTCTGTTGTAACTGACTATCAAAACCTTAAAAGCAGATTCAGTTACCTGGGATTT
GGTGGTTTTGCCAGTGTGGCTAATCAAGGACAGATAACCAGATTTGGTTTGGGTACTCAAGAAATAGTAAACCCTGTA
AGACATGATAAAGTTAATTTCCCCTTTGGGTTTAAATTTAATATAGCAGTTGGATTCATTTTGTGTATTAGTTTGGTT
ATTTTAACTTTTCAATGGCGGTTTTACCTTTCCTTTAGAAAGCTAATGCGCTGTGTATTAATACTTGTTATTGCCTTG
TGGTTTATTGAGCTTCTGGATGTATGGAGTACATGCACTCAGCCCATCTGTGCAAAATGGACAAGGACTGAAGCTAAG
GCAAATGAGAAGGTCATGATTTCTGAAGGGCATCATGTGGATCTTCCTAATGTTATTATTACCTCACTCCCTGGTTCA
GGAGCTGAAATTCTCAAACAGCTTTTTTTTCAACAGCAGTGATTTTCTCTACATCAGAATTCCTACAGCCTACATGGAT
ATCCCTGAAACTGAATTTGAAATTGACTCATTTGTAGATGCTTGTGAGTGGAAAGTATCAGATATCCGCAGTGGGCAC
TTTCATCTTCTTCGAGGGTGGCTGCAGTCTTTGGTCCAGGATACAAAACTTCACTTGCAAAACATCCATCTACATGAA
ACCAGTAGGAGTAAACTGGCCCAATATTTTACAACTAATAAGGACAAAAAGCGAAATTAAAAAGAAGGGAGTCTTTG
CAAGATCAAAGAAGTAGAATAAAAGGACCATTTGATAGAGATGCTGAATATATTAGGGCTTTAAGAAGACACCTTGTT
TATTACCCAAGTGCACGTCCTGTGCTCAGCTTAAGTAGTGGTAGCTGGACATTGAAGCTTCATTTTTTTCAGGAAGTT
TTAGGAACTTCAATGCGGGCATTGTACATAGTAAGAGACCCTCGAGCTTGGATCTATTCAGTGCTATATGGTAGTAAA
CCAAGTCTTTATTCTTTGAAGAATGTACCAGAGCACTTAGCAAAATTGTTTAAAATAGAGGAAGGTAAAAGCAAATGT
AATTCGAATTCTGGCTATGCTTTTGAGTATGAATCACTGAAGAAAGAATTAGAAATATCCCAATCAAATGCTATCTCC
TTATTATCTCATTTGTGGGTAGCAAACACTGCAGCAGCCTTGAGAATAAATACAGATTTGCTGCCTACCAATTACCAT
CTGGTCAAGTTTGAAGATATTGTTCATTTTCCTCAGAAGACTACTGAAAGGATTTTTGCTTTCCTTGGCATTCCTTTG
TCTCCTGCTAGTTTAAACCAAATGCTATTTGCCACTTCCACAAACCTTTTTTATCTTCCATATGAGGGGGAAATATCA
CCATCTAATACTAATATTTGGAAAACAAACTTGCCTAGAGATGAAATTAAACTAATTGAAAACATTTGCTGGACACTG
ATGGATCATCTAGGATATCCAAAGTTTATGGACTAAatgctgcaggtcggcaaaatttgcactaatgtgtcccaacct
actttgtggatatgaactagaaaactttgtttattcttgtacatgtatgtatgtgtgtagagtgagtgcgtgtgtcca
gtatgttatttgcacagagatattttcaaaataggcaccatatttggcctagcaggatttattttttatgttaccactt
ttcttgcctttgtttctgaatttttttctgctaaaatgtttctgctacagaggtatatattctgggggttctgaaatat
ggggtttttaatggactttaactcaacttctttggaaactatttatctatcttaggacctcaaacactacaaacggcct
tgcaattgctgctgtatctagtcatctctcgctcttaatatggactacaaaactttatgttttgaaaacgtctaacat
ttaccttgcacacaaaaacgagaataaaaaaccaaaaattaaaaaaaaaaaaaaaaaaaaaaa
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ALPHA, GST-4BETA, & GST-6
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FIG. 6B

(mouse GST-6, translation of ORF)

MAFMFTEHLLFLTLMMCSFSTCEESVSNYSEWAVFTDDIQWLKSQKIQDFKLNRRLHPN
LYFDAGDIQTLKQKSRTSHLHIFRAIKSAVTIMLSNPSYYLPPPKHAEFAAKWNEIYGNN
LPPLALYCLLCPEDKVAFEFVMEYMDRMVSYKDWLVENAPGDEVPVGHSLTGFATAF
DFLYNLLGNQRKQKYLEKIWIVTEEMYEYSKIRSWGKQLLHNHQATNMIALLIGALVT
GVDKGSKANIWKQVVVDVMEKTMFLLKHIVDGSLDEGVAYGSYTSKSVTQYVFLAQR
HFNINNFDNNWLKMHFWFYYATLLPGYQRTVGIADSNYNWFYGPESQLVFLDKFILQN
GAGNWLAQQIRKHRPKDGPMVPSTAQRWSTLHTEYIWYDPTLTPQPPVDFGTAKMHTF
PNWGVVTYGGGLPNTQTNTFVSFKSGKLGGRAVYDIVHFQPYSWIDGWRSFNPGHEHP
DQNSFTFAPNGQVFVSEALYGPKLSHLNNVLVFAPSPSSQCNQPWEGQLGECAQWLKW
TGEEVGDAAGEVITAAQHGDRMFVSGEAVSAYSSAMRLKSVYRALLLLNSQTLLVVDH
IERQETSPINSVSAFFHNLDIDFKYIPYKFMNRYNGAMMDVWDAHYKMFWFDHHGNSP
VANIQEAEQAAEFKKRWTQFVNVTFHMESTITRIAYVFYGPYVNVSSCRFIDSSSSGLQIS
LHVNSTEHSVSVVTDYQNLKSRFSYLGFGGFASVANQGQITRFGLGTQEIVNPVRHDKV
NFPFGFKFNIAVGFILCISLVILTFQWRFYLSFRKLMRCVLILVIALWFIELLDVWSTCTQPI
CAKWTRTEAKANEKVMISEGHHVDLPNVIITSLPGSGAEILKQLFFNSSDFLYIRIPTAYM
DIPETEFEIDSFVDACEWKVSDIRSGHFHLLRGWLQSLVQDTKLHLQNIHLHETSRSKLA
QYFTTNKDKKRKLKRRESLQDQRSRIKGPFDRDAEYIRALRRHLVYYPSARPVLSLSSGS
WTLKLHFFQEVLGTSMRALYIVRDPRAWIYSVLYGSKPSLYSLKNVPEHLAKLFKIEEG
KSKCNSNSGYAFEYESLKKELEISQSNAISLLSHLWVANTAAALRINTDLLPTNYHLVKF
EDIVHFPQKTTERIFAFLGIPLSPASLNQMLFATSTNLFYLPYEGEISPSNTNIWKTNLPRD
EIKLIENICWTLMDHLGYPKFMD .

FIG. 7